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Ministry of Economic Affairs and Employment
P.O. Box 32
FI-00023 Government, Finland

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Statement of the Radiation and Nuclear Safety Authority's on the operating licence of the Olkiluoto 3 nuclear power plant unit

In its reference letter, the Ministry of Economic Affairs and Employment has requested the Radiation and Nuclear Safety Authority (STUK) to provide a statement under Section 23 of the Nuclear Energy Act on the operating licence application regarding Teollisuuden Voima Oyj's (TVO) Olkiluoto 3 nuclear power plant unit. In its application, TVO applies for a licence under Section 20 of the Nuclear Energy Act for the following activities:

- operation of the Olkiluoto 3 nuclear power plant unit from the beginning of year 2018 to the end of year 2038.
- to place in interim storage spent fuel generated by the operation of the Olkiluoto 3 nuclear power plant unit in the spent fuel interim storage that is already operational at Olkiluoto pursuant to the operating licence concerning the interim storage from the beginning of year 2018 to the end of year 2038.
- to place in interim storage nuclear waste generated by the operation of the Olkiluoto 3 nuclear power plant unit in the interim storage for intermediate level waste and in the interim storage for low level waste pursuant to the operating licence concerning the interim storages from the beginning of year 2018 to the end of year 2038.
- to place in interim storage, at the Olkiluoto 3 nuclear power plant unit, power plant waste generated by the operation of the nuclear facilities located on the island of Olkiluoto from the beginning of year 2018 to the end of year 2038.

TVO has provided the Ministry of Economic Affairs and Employment with an operating licence application and requisite appendices necessitated by Section 33 of the Nuclear Energy Decree. For the performance of STUK's safety review, TVO has submitted to STUK directly the documents specified in Section 36 of the Nuclear Energy Decree.

STUK has prepared the safety assessment, which is included as Appendix 1 to this statement, based on reviewing the documents provided by TVO and the results of other oversight measures on the Olkiluoto 3 nuclear power plant unit. Appendix 2 is a description of the requisite documents specified in Section 36(1) of the Nuclear Energy Decree. Appendix 3 is the statement required from the Advisory Committee on Nuclear Safety, as referred to in Section 56(2) of the

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Nuclear Energy Act, in accordance with Section 37 of the Nuclear Energy Decree.

General safety principles for the use of nuclear energy

The following provisions on the safety of the use of nuclear energy are laid down in Sections 5–7 of Chapter 2 of the Nuclear Energy Act.

Section 5: *The use of nuclear energy, taking into account its various effects, shall be in line with the overall good of society.*

Section 6: *The use of nuclear energy must be safe, it shall not cause injury to people, or damage to the environment or property.*

Section 6 a: *Nuclear waste generated in connection with or as a result of use of nuclear energy in Finland shall be handled, stored and permanently disposed of in Finland.*

Section 7: *Sufficient physical protection and emergency planning as well as other arrangements for limiting nuclear damage and for protecting nuclear energy against illegal activities shall be a prerequisite for the use of nuclear energy.*

STUK's oversight work has not revealed any issues that would keep the licence holder and the Olkiluoto 3 nuclear power plant unit from meeting the principles laid down in Sections 5–7 of the Nuclear Energy Act.

Preconditions for granting the operating licence

The use of nuclear energy is subject to a licence (Nuclear Energy Act, Section 8). According to Section 20 of the Nuclear Energy Act, the granting of an operating licence requires the following conditions to be met:

1. *the nuclear facility and its operation meet the safety requirements laid down in this Act, and appropriate account has been taken of the safety of workers and members of the public, and environmental protection;*
2. *the methods available to the applicant for arranging nuclear waste management, including final disposal of nuclear waste and decommissioning of the facility, are sufficient and appropriate;*
3. *the applicant has sufficient expertise available and, in particular, the competence of the operating staff and the operating organisation of the nuclear facility are appropriate;*
4. *the applicant is otherwise considered to have the financial and other prerequisites to engage in operations safely and in accordance with Finland's international contractual obligations; and*

the planned nuclear facility and the operation thereof otherwise fulfils the principles laid down in sections 5–7.

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Operation of the nuclear facility shall not be started on the basis of a licence granted:

- 1. STUK has noted that the nuclear power plant fulfils the set safety requirements and that the physical protection and emergency preparedness are sufficient, that the control necessary for preventing the spreading of nuclear weapons has been arranged appropriately and that the nuclear plant owner's liability for nuclear damage has been taken care of according to legislation; and*
- 2. until the Ministry of Trade and Industry has ascertained that provision for the cost of nuclear waste management has been arranged in accordance with the provisions of Chapter 7.*

The realisation of each item is discussed below. In the safety review in Appendix 1, the Radiation and Nuclear Safety Authority presents a more detailed assessment of the realisation of the items in its mandate.

- 1. the nuclear facility and its operation meet the safety requirements laid down in this Act, and appropriate account has been taken of the safety of workers and members of the public, and environmental protection;*

The Olkiluoto 3 nuclear power plant unit has been designed to comply with the requirements on the nuclear safety and radiation safety of plants during operation. The defence-in-depth principle has been observed in the design. The principles of redundancy, diversity and separation have been observed as a part of the defence-in-depth principle in the design of systems performing safety functions. Various internal and external hazards have also been taken into account in the design. Internal hazards include, for example, fire or flooding. External hazards include various natural disasters, extreme weather conditions and illegal action. For example, the crash of a large commercial airliner has been considered in design.

Preparing for severe reactor accidents has been the design basis of the Olkiluoto 3 nuclear power plant unit. The nuclear power plant unit has been designed to have independent systems for bringing it to a safe state after a severe reactor accident and to guarantee the integrity and leak-tightness of the containment. When the containment remains leak-tight, releases are minor and the accident will not necessitate protective measures outside the plant area in the early stages, large-scale protective measures later on nor long-term restrictions on the use of land or water areas. According to probabilistic risk assessment, the probability of failure to accomplish the aims described above is extremely low.

TVO has prepared for operational occurrences and accidents at the Olkiluoto 3 nuclear power plant unit in accordance with the safety requirements. TVO has presented analyses of the releases and radiation doses caused by normal operation, operational occurrences and accidents. Radiation doses caused by the normal operation of the

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Olkiluoto 3 nuclear power plant unit and any abnormal operation or accidents are below the limits for radiation exposure laid down in the Nuclear Energy Decree.

2. *the methods available to the applicant for arranging nuclear waste management, including final disposal of nuclear waste and decommissioning of the facility, are sufficient and appropriate*

The starting point of the nuclear waste management of the Olkiluoto 3 nuclear power plant unit is that the nuclear waste is managed fully at Olkiluoto, including its final disposal. Operation of the plant generates low- and intermediate-level radioactive waste as well as high-level spent fuel. After operation of the plant unit ends, its decommissioning and demolition will generate radioactive demolition waste, which will be treated mainly with the same procedures as the low- and intermediate-level radioactive waste.

The nuclear waste management of the Olkiluoto 3 nuclear power plant unit will use the same procedures developed by TVO for the nuclear waste management of the Olkiluoto 1 and 2 nuclear power plant units. The operational waste generated during the operation of the Olkiluoto 3 nuclear power plant unit will be stored and deposited in the same facilities as the waste generated at the Olkiluoto 1 and 2 nuclear power plant units.

The Olkiluoto power plant site includes storage facilities for low- and intermediate-level waste (MAJ and KAJ storages), a repository for low and intermediate-level waste (VLJ repository) and an interim storage for spent fuel (KPA storage). Furthermore, the OL3 nuclear power plant unit has facilities for the treatment and storage of nuclear waste, which can be used for the interim storage of nuclear waste generated in conjunction with or as a result of the operating of the Olkiluoto nuclear power plant units.

The MAJ and KAJ stores and the KPA store are included in the operating licence of the Olkiluoto 1 and 2 nuclear power plant units, which was renewed on 20 September 2018 and is valid until the end of 2038. The application to renew the operating licence took into account the possession, handling and storage of the Olkiluoto 3 nuclear power plant unit's nuclear waste in the MAJ, KAJ and KPA storages. There is a separate operating licence for the VLJ repository, which is valid until the end of the year 2051. The operating licence was issued in 1992, and in 2012 the licence terms were amended to also permit the operational waste of the Olkiluoto 3 nuclear power plant unit to be deposited in the repository.

The final disposal plan for spent nuclear fuel is based on Posiva Oy's final disposal project. The Government granted a construction licence for the encapsulation plant and final disposal facility in November 2015. According to Posiva Oy's current schedule, the final disposal of spent

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nuclear fuel could begin during 2024. Posiva Oy has planned to submit an operating licence application for the encapsulation plant and final disposal facility in 2020.

Immediate decommissioning after the end of commercial operation has been chosen as the decommissioning strategy for the Olkiluoto 3 nuclear power plant unit. A separate decommissioning license must be applied for the decommissioning, the safety of the decommissioning is evaluated in context of the application. The decommissioning plan for the Olkiluoto 3 nuclear power plant unit presented by TVO in the operating licence documentation describes the matters related to the decommissioning of the plant unit and the subsequent nuclear waste management in sufficient detail for the purpose of the operating licence phase.

The methods available to TVO for arranging nuclear waste management are adequate and appropriate.

3. *the applicant has sufficient expertise available and, in particular, the competence of the operating staff and the operating organisation of the nuclear facility are appropriate;*

TVO has prepared for the operation of the Olkiluoto 3 nuclear power plant unit by recruiting the necessary personnel from an early phase of the project. The construction and commissioning of the plant unit have provided an opportunity to get acquainted with the plant before the operation begins. Personnel training has been designed and implemented in accordance with the instructions in TVO's training manual. Based on the various tasks and responsibilities, the training manual includes requirements for basic qualification and work experience, required and recommended activity-specific qualification requirements, qualification requirements for special roles as well as permit-specific qualification and orientation requirements. The plant supplier has also provided operation, maintenance and technical support training and job orientation for TVO personnel.

According to the Nuclear Energy Act, only a person approved by the Radiation and Nuclear Safety Authority (STUK) for the position in question may act as a nuclear facility operator in the control room of the facility. The Radiation and Nuclear Safety Authority approved all the operators of the Olkiluoto 3 nuclear power plant unit at the end of 2018.

The operating organisation of the Olkiluoto 3 nuclear power plant unit has been a part of the operations unit operating under TVO's electricity production starting already from the construction phase. Within the operations unit, there is a separate operations division for each plant unit. In addition to the operations unit, other units operating under the electricity production include the fuel, maintenance and production support units common to all plant units. TVO has been preparing for transfer into the operating phase for a long time. In addition to the

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recruitment and training described above, an important part of the preparation has been updating TVO's procedures to also cover the Olkiluoto 3 nuclear power plant unit, or drawing up new procedures when necessary due to differences between the plant units.

Pressurised water reactor is a new type of plant for TVO. However, TVO has during the project familiarized itself with the plant type and its characteristics and acquired the expertise required for the safe operation of the plant. According to the assessment of STUK, TVO has sufficient resources and competence to safely operate the Olkiluoto 3 nuclear power plant unit.

TVO has exhibited significant problems related to work atmosphere in recent years and the staff turnover has increased from previous years, which has also reflected in the formation of the organisation needed for operating the Olkiluoto 3 nuclear power plant unit. TVO has carried out significant organizational culture development programmes due to the atmosphere difficulties. Based on STUK's control activities, TVO has implemented development measures related to management, safety culture and development measures related to staff resourcing and competence in a systematic manner. In STUK's assessment, the aspects necessitated by Section 25 of Regulation STUK Y/1/2018 are at an acceptable level. The implementation of development measures related to management, safety culture as well as staff resourcing and competence must be continued. STUK will monitor the development of the situation and the effects of development measures as a part of its continuous regulatory work.

4. The applicant is otherwise considered to have the financial and other prerequisites to engage in operations safely and in accordance with Finland's international contractual obligations;

As regards Section 20(1)(4) of the Nuclear Energy Act, STUK notes that it lacks the authority and competence to assess the licence holder's financial capacity for operating the power plant. In this statement and the appendices thereto, STUK's assessment has focused particularly on the licence holder's capabilities to conduct the operations safely and, with regard to matters under STUK's regulatory control, in accordance with Finland's international agreement obligations.

Operation of the nuclear facility shall not be started on the basis of a licence granted:

1. STUK has noted that the nuclear power plant fulfils the set safety requirements and that the physical protection and emergency preparedness are sufficient, that the control necessary for preventing the spreading of nuclear weapons has been arranged appropriately and that the nuclear plant owner's liability for nuclear damage has been taken care of according to legislation;

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The Radiation and Nuclear Safety Authority has approved the plans for physical protection, emergency preparedness and safeguards, but the implementation of physical protection measures and equipping emergency response premises is still under way. Furthermore, pre-operational testing of equipment and systems is not yet completed. Some maintenance and repair work and finalizing installation and construction work is also still being done. STUK oversees the progression of the work and verifies before the start of operation that the all preparations have been completed according to the plans.

The operating procedure for emergencies and abnormal situations have been tested with the full scope simulator. In the testing, needs for corrections and improvements were recognized. The work is still ongoing, and the scope of possible retesting has not yet been defined. The Radiation and Nuclear Safety Authority has not yet received sufficient evidence that suitable instructions are available for the identification and control of incidents for operational occurrences and accidents. The Radiation and Nuclear Safety Authority requires that the preparation and validation of operating procedures, including guidelines for managing severe accidents, be completed before starting operation. TVO must demonstrate to the Radiation and Nuclear Safety Authority before fuel loading that the procedures specified above form an entity that is appropriate for the intended purpose and sufficient for the safe starting of operation of the Olkiluoto 3 nuclear power plant unit.

During the pre-operational testing of the Olkiluoto 3 nuclear power plant unit, it emerged that the vibration of the surge line of a pressuriser that is a part of the primary circuit exceeds the set criteria. TVO and the plant supplier have investigated solutions to dampen the vibrations. Alternative solutions exist, and the studies to find out the optimal solution considering safety are ongoing. STUK's position is that the discussed solutions will dampen the vibration sufficiently. STUK will review the detailed plans of the solution chosen by TVO, oversee the progress of the work and verify before fuel loading that modifications necessary for safe operation have been implemented and the necessary tests have been performed.

The final piping analyses are still unfinished, for example the analyses of forces caused by piping on connections of the main components of the primary circuit. The Radiation and Nuclear Safety Authority will review these analyses before starting operation of the plant.

The Radiation and Nuclear Safety Authority will ascertain that the prescribed safety requirements are met as provided in Section 20(2) of the Nuclear Energy Act following the issuance of the operating licence for the nuclear facility and before fuel is loaded into the reactor. Such ascertainment is a necessary prerequisite for the commencement of operation of the nuclear facility. At this inspection, which may be comprised of several intermediate inspections, STUK will verify that the requirements set out in the legislation, official regulations, conditions

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and the decisions issued by STUK are duly satisfied, and that the plant can be safely started. Among other things, the inspection will address the following items to ensure that:

- The documents needed for the plant's operation are up to date.
- The instruction manuals concerning operation of the plant, including emergency operating procedures, are adequate.
- The organization operating the nuclear facility is appropriate and adequate.
- The persons involved in the use of nuclear energy meet the competence requirements.
- There is a sufficient number of licensed operators at the plant.
- The results of system performance tests are acceptable insofar as it is possible to perform such testing before the loading of fuel into the reactor.
- The commissioning inspections of the plant's systems, structures and components have been carried out with acceptable results.
- Non-destructive testing of the structures and components have been completed acceptably.
- The physical protection and emergency preparedness arrangements are sufficient.
- The necessary control to prevent the proliferation of nuclear weapons has been arranged appropriately.
- The licence holder of the nuclear facility has arranged indemnification regarding liability in the case of nuclear damage as prescribed.

Conclusion

Teollisuuden Voima Oyj applied for a licence for the following activities:

- operation of the Olkiluoto 3 nuclear power plant unit from the beginning of year 2018 to the end of year 2038.
- to place in interim storage spent fuel generated by the operation of the Olkiluoto 3 nuclear power plant unit in the spent fuel interim storage that is already operational at Olkiluoto pursuant to the operating licence concerning the interim storage from the beginning of year 2018 to the end of year 2038.
- to place in interim storage nuclear waste generated by the operation of the Olkiluoto 3 nuclear power plant unit in the interim storage for intermediate level waste and in the interim storage for low level waste pursuant to the operating licence concerning the interim storages from the beginning of year 2018 to the end of year 2038.
- to place in interim storage, at the Olkiluoto 3 nuclear power plant unit, power plant waste generated by the operation of the nuclear facilities located on the island of Olkiluoto from the beginning of year 2018 to the end of year 2038.

Pursuant to Section 24 of the Nuclear Energy Act, an operating licence is granted for a fixed term and, in considering the length of the term,

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particular attention must be paid to ensuring safety and to the estimated duration of operations.

The design service life of the Olkiluoto 3 nuclear power plant unit is 60 years. TVO is applying for an operating licence until the end of 2038.

In this statement, STUK has assessed that the operations intended by the licence applicant are safe and meet the requirements laid down in the applicable legislation. STUK has found no reasons that would prevent the granting of the licence in accordance with the application until 2038. The nuclear energy legislations provides STUK with the means to intervene with the use of nuclear energy when safety concerns require it to do so.

If the operating licence is granted for the period indicated in the application, a periodic safety review must be conducted on the Olkiluoto 3 nuclear power plant unit during the licence period in accordance with the Nuclear Energy Act. The relevant procedures are described in more detail in Guide YVL A.1. As a proposed licence condition, STUK presents that the licence holder must conduct a periodic safety review on the Olkiluoto 3 nuclear power plant unit and deliver it to STUK for approval by the end of 2028.

Preparations for the commencement of operation of the Olkiluoto 3 nuclear power plant unit are still partially incomplete. The operation is considered to commence when fuel loading into the reactor begins. STUK is monitoring the progression of the preparations and, before granting fuel loading permission, will carry out an inspection to verify that the preconditions for safe operation are met in all respects. Such ascertainment is a necessary prerequisite for the commencement of operation of the nuclear facility.

Director General Petteri Tiippana

Director Kirsi Alm-Lytz

Appendices

1. The Radiation and Nuclear Safety Authority's safety review of the operating licence application for the Olkiluoto 3 nuclear power plant unit, 25.2.2019
2. Assessment of the documents prescribed in Section 36 of the Nuclear Energy Decree, 25.2.2019
3. Statement from the Advisory Committee on Nuclear Safety, 28.11.2018